5.16.23 FLEXURAL STRENGTH OF CONCRETE (THIRD-POINT LOADING) (Kansas Test Method KT-23)

a. SCOPE

This method of test covers the procedure for determining the flexural strength of concrete by test of a sample beam with third-point loading. KT-23 reflects testing procedures found in AASHTO T 97.

b. REFERENCED DOCUMENTS

b.1. KT-22; Making and Curing Compression and Flexural Test Specimens in the Field

b.2. AASHTO T-97; Flexural Strength of Concrete (Using Simple Beam with Third Point Loading)

c. APPARATUS

c.1. A testing machine which will apply a measured load to the beam at the third points of the span. The machine will have a span length of 460 mm (18 in). Suitable machines are made available to the Field Engineer by the District Materials Engineer.

c.2. Caliper and a 300 mm (12 in) steel rule graduated in 0.1 mm (0.01 in).

c.3. Leather shims, 6.4 by 38 by 160 mm (1/4 by 1 1/2 by 6+ in). The shim must be slightly longer (160 mm) than the test specimen.

d. TEST SPECIMEN

A nominal 152.4 by 152.4 by 530 mm (6 by 6 by 21 in)[1] concrete beam, molded and cured according to KT-22. The beam must be kept moist until time of test.

e. TEST PROCEDURE

e.1. Age of Testing: Unless directed otherwise by the Field Engineer, beams representing concrete pavement are to be tested at the following ages:

First Test.....7 days
Second Test.....14 days

Beams tested to determine the safe date for removal of forms from structures shall be tested at ages mutually agreed upon by the Engineer and the Contractor.

[1] The length dimension is 25.4 mm (1 in) longer than AASHTO.

Other times for testing are contained in the standard specifications.

e.2. Install Specimen: Place the specimen on its side in the machine in such a manner that a minimum of 25 mm (1 in) of the beam extends outside the support rollers. If full contact is not obtained at no load between the specimen and the load-applying blocks and the supports so that there is a 25 mm (1 in) or longer gap in excess of 0.1 mm (0.004 in), grind or cap the contact surfaces of the specimen, or shim with leather strips.

e.2.1. Use leather shims only when the specimen surfaces in contact with the blocks or supports depart from a plane by not more than 0.38 mm (0.015 in).

e.3. Application of Load: The load may be applied rapidly until approximately 50 percent of the breaking load has been reached. Beyond that point, reduce the rate of loading so that the rate of increase in extreme fiber stress remains within 861 to 1207 kPa (1500 to 2100 lbf) per minute until the specimen breaks.

e.3.a. Chart No. 416TCM (see figure 1) is the correct chart to use on the Rainhart Beam Breaker. This chart loads at a rate of 1016 kPa/min (1764 lbf/min).

Note and record the total load required to break the beam.

e.4. Measurement: Take three measurements across each dimension (one at each edge and at the center) to the nearest 1.3 mm (0.05 in) to determine the average width, average depth, and line of fracture location of the specimen at the section of failure.

e.4.1. If fracture occurs at a capped section, include the cap thickness in the measurement.

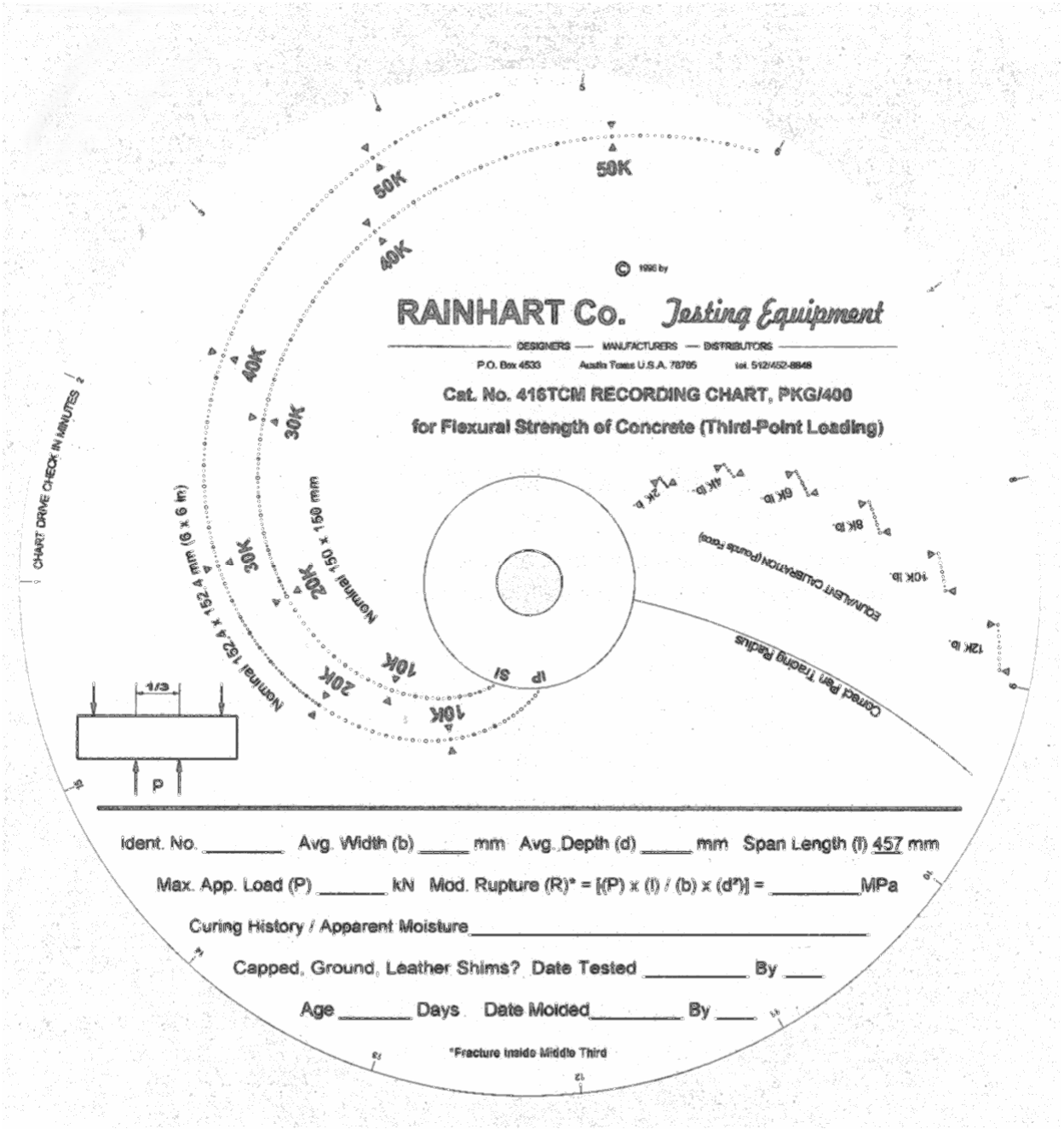
50K
50K
40K
40K
30K
30K
20K
20K
10K
10K
© 1996 by
RAINHART Co. Testing Equipment
DESIGNERS — MANUFACTURERS — DISTRIBUTORS
P.O. Box 4533 Austin Texas U.S.A. 78765 tel. 512/452-8848
Cat. No. 416TCM RECORDING CHART, PKG/400
for Flexural Strength of Concrete (Third-Point Loading)
CHART DRIVE CHECK IN MINUTES
Nominal 152.4 x 152.4 mm (6 x 6 in.)
Nominal 150 x 150 mm
EQUIVALENT CALIBRATION (Pounds Force)
Correct Pen Tracing Radius
P1 2K lb.
4K lb.
6K lb.
8K lb.
10K lb.
12K lb.
1/3
P
Ident. No. _____ Avg. Width (b) _____ mm Avg. Depth (d) _____ mm Span Length (l) 457 mm
Max. App. Load (P) _____ kN Mod. Rupture (R)* = [(P) x (l) / (b) x (d²)] = _____MPa
Curing History / Apparent Moisture_____
Capped, Ground, Leather Shims? Date Tested _____ By ____
Age _____ Days Date Molded_____ By ____
*Fracture Inside Middle Third

Figure 1

f. CALCULATIONS

f.1. If the fracture initiates in the tension surface within the middle third of the span length, calculate the modulus of rupture as follows:

$$R = \frac{1000(P)(L)}{bd^2} \quad \text{(SI)}$$

$$R = \frac{(P)(L)}{bd^2} \quad \text{(ENGLISH)}$$

Where: R = Modulus of rupture in kPa (psi).
P = Maximum applied load in Newtons (N) (lbf)
L = Span length in mm (in)
b = Avg. Width of specimen in mm (in) (as tested)
d = Avg. Depth of specimen in mm (in) (as tested)

Sample Calculations (SI):
Depth of beam = 145 mm
Width of beam = 155 mm
Span length = 460 mm
Load at break = 21400 N

$$R = \frac{1000(21400)(460)}{155(145)(145)} = 3\ 020 \text{ kPa}$$

Sample Calculations (ENGLISH):
Depth of beam = 5.70 in
Width of beam = 6.12 in
Load at break = 4800 lbf

$$R = \frac{4800(18)}{6.12(5.70)(5.70)} = 435 \text{ psi}$$

f.2. If the fracture occurs in the tension surface outside of the middle third of the span length by not more than 5 percent of the span length, calculate the modulus of rupture as follows:

$$R = \frac{3000(P)(a)}{bd^2} \quad \text{(SI)}$$

$$R = \frac{3(P)(a)}{bd^2} \quad \text{(ENGLISH)}$$

where: a = average distance between line of fracture and the nearest support measured on the tension surface of the beam, mm (in).

If the fracture occurs in the tension surface outside of the middle third of the span length by more than 5 percent of the span length, discard the results of the test.